SC

ENABLING INTEROPERABLE OBJECT-BASED APPROACHES TO DEVELOPING AND PRESENTING E-LEARNING.

BY PETER BERKING

Creating e-learning that is neither reusable nor interoperable may be a significant business risk for your organization, since you may not be able to run your content in more than one learning management system (LMS) should you have to change vendors, lose support for an existing system, or need to share content with another government organization or even another agency within your own organization.

To that end, the Advanced Distributed Learning Initiative (ADL) developed the Sharable Content Object Reference Model (SCORM) with a vision to provide access to the highest-quality learning and performance aiding that can be tailored to individual needs and delivered cost-effectively, anywhere and anytime.

ADL develops and implements learning technologies across the U.S. Department of Defense and federal government. ADL collaborates with government, industry, and academia to promote international specifications and standards for designing and delivering learning content. The Department of Defense (DoD) Office of the Under Secretary of Defense for Personnel and Readiness (OUSD P&R) oversees the ADL Initiative.

In this article, vendor citations or descriptions are included for illustrative purposes and do not constitute an endorsement by the ADL Initiative. All listings of vendors and products are in alphabetical order unless otherwise noted.

ORM and Authoring Tools

OVERVIEW OF SCORM

The ADL Initiative identified four functional requirements for distributed learning environments.

>> Accessibility: the ability to locate and access instructional components from multiple locations and deliver them to other locations

>> Interoperability: the ability to take instructional components developed in one system and use them in another system

>> Durability: the ability to withstand technology changes over time without costly redesign, reconfiguration, or recoding

>> Reusability: the ability to use instructional components in multiple applications and contexts

SCORM integrates a set of related technical standards, specifications, and guidelines that standardize the communication between sharable content objects (SCOs) and learning management systems (LMSs) using an Application Programming Interface (API) and a prescribed data model that define the types of data that are stored in an LMS. Interoperability is achieved with the SCORM content package, a self-contained dot-zip file that includes everything needed to deliver content to learners via a SCORM 2004-conformant LMS. For more information on SCORM, visit www.ADLNet.gov.

SCORM neither dictates nor precludes any instructional, performance support, or assessment strategy. SCORM enables interoperable object-based approaches to the development and presentation of e-learning by allowing developers to aggregate learning content composed of relatively small, reusable SCOs to form meaningful units of instruction. Individual content objects can then be designed for reuse in multiple contexts, and aggregated in various ways to assemble new and different programs of instruction.

This object-based approach, intended to support reuse, means that hard-coding the presentation order of SCOs could impede the ability to reuse individual SCOs. ADL addressed this problem by standardizing a set of behaviors and rules, called sequencing, which all SCORM 2004-conformant LMSs must support. These behaviors are programmed in XML into the SCORM manifest file rather than being hard-coded into individual SCOs. Programming the behaviors into the manifest file allows the LMS, rather than the individual SCOs, to control the movement of learners between SCOs.

WHAT DOES THIS MEAN FOR AUTHORING TOOLS?

As a vendor-neutral organization, ADL cannot recommend specific vendors or tools. However, ADL does recommend the use of authoring tools with built-in features that allow you to create SCORM-conformant e-learning.

For an authoring tool to robustly support SCORM, the authoring tool should:

- >> support object-based learning design;
- >> allow SCOs to be defined at any level of the content structure;
- >> support all SCORM data model elements without requiring complex programming or advanced knowledge of the SCORM data model;
- >> create SCORM-conformant content packages;
- >> allow direct viewing and editing of the content package's xml manifest file;
- >> provide tools enabling the reuse of content packages and manifests in creating new content packages and manifests;
- >> include a simple way to define sequencing and navigation rules; and
- >> include a metadata editor that can be customized to the metadata profile your organization uses. Ideally, some of this metadata is inferred or extracted from existing properties of the courseware, without requiring manual entry.

> **Only the content produced by the tools can be assessed for conformance.**

Authoring tools support SCORM's functionality to varying degrees, with varying implementations. If you are in the process of acquiring an authoring tool, evaluate how fully each tool supports each of the requirements listed above, and in what way. The depth of support for SCORM can make a big difference in the level of effort required to produce SCORM-conformant e-learning.

If you want to start producing SCORM content with a tool you already own, you should talk to your vendor or read the documentation carefully to determine what its limitations are. For instance, some tools advertise SCORM conformance but do not allow you to define SCOs at any level of aggregation; you can only define the entire entity as a single SCO, limiting interoperable sequencing as well as the reuse of individual SCOs.

DETERMINING LEVEL AND QUALITY OF SCORM SUPPORT

To evaluate an authoring tool in terms of SCORM support, first determine the target SCORM conformance version for your content. For example, SCORM 2004 4th Edition, released in March of 2009, is the current version. LMSs can lag several versions behind the current version for several reasons: your organization may not have purchased product upgrades for new SCORM versions, the product may be going through an update cycle for a new version of SCORM and has not been publicly released yet, or your organization is delaying upgrading to a new version for various reasons.

Since SCORM is not backward-compatible (especially between SCORM 2004 and SCORM 1.2), you need to know the version of SCORM that your LMS supports and whether the LMS has been certified at that level. Certified Products are those products that have been independently tested by ADL Certification Testing Centers to meet the requirements as described by the corresponding version of the SCORM Testing Requirements document and verified by the ADL SCORM Test Suite.

Authoring tools cannot be

SCORM conformant, SCORM compliant, or SCORM certified; only the content produced by the tools can be assessed for conformance. Moreover, depending on the configuration and parameters the author sets for the tool's output, the content may or may not be conformant. This variability injects too much uncertainty in any determination of conformance. Therefore, authoring tools are not defined as SCORM conformant, SCORM compliant, or SCORM certified.

You should acquire a sample SCORM-conformant e-learning course produced by any tools you are evaluating, and test them on your target LMS. LMSs may implement and interpret the same SCORM requirements differently in some cases — even if both conform to the same version of SCORM. This may impact your decision to purchase a particular tool, or determine whether the tool you own is reliable enough to use for SCORM output.

If you do not have a target LMS available for testing, you can use the ADL Sample Run-Time Environment to see how your authoring tool's output runs in a fully SCORM-conformant LMS.

You should also run both a sample SCO and content package produced by the authoring tool through the ADL SCORM Test Suite to verify the level of conformance the authoring tool produces. The Test Suite record can serve as a point of reference in cases where your SCORM content should run in your target (conformant) LMS, but it does not.

One possible approach to comparing authoring tools for SCORM support involves creating the same SCO in multiple authoring tools and testing each one in turn in the SCORM Test Suite. Creating the same piece of content in various authoring tools compares the important task automation features of each tool — a comparison that necessarily involves subjective judgments — while "leveling the playing field" as much as possible. The test logs themselves augment the subjective aspects of testing by providing standardized and objectively developed records that depict each SCO's degree of success in supporting SCORM.

SUPPORT FOR SCORM 2004 SEQUENCING AND NAVIGATION

Currently, most self-contained authoring systems do not support SCORM 2004 sequencing and navigation. You may need to create your sequencing rules either by directly coding the manifest file (using XML) or by using a tool such as the Reload Editor (see next section), which provides a GUI interface for defining sequencing and navigation. However, the terms and techniques needed to use the Reload Editor, and most other tools that do implement sequencing and navigation, require a thorough understanding of the sequencing and navigation behaviors and rules defined in the SCORM 2004 Sequencing and Navigation book. Sequencing and navigation is complicated and even the tools designed to make it easier are not for the "technically challenged."

Although most authoring tools do not provide the ability to generate SCORM 2004 sequencing rules from scratch, some allow you to choose from pre-designed sequencing templates. Sequencing templates provide the structure and rules for common instructional strategies such as pre- and post-testing, remediation and learner choice. You simply replace the sample SCO references with your own SCO identifiers and repackage your content. The Reload Editor includes sequencing templates, as well as the ability to define custom rules using a form with drop-down menus, allowing selection of rule operators.

SCORM ADOPTERS

SCORM Adopters are product vendors that design products that conform to SCORM. The SCORM Adopter authoring tools typically have built-in features to support achieving SCORM conformance. In many cases, however, some manual coding is necessary to create fully SCORM-conformant e-learning (for example, in the HTML/JavaScript "wrapper" for SCOs). Furthermore, many of these tools do not automate the creation of SCORM content packages (dot-zip files containing XML manifest files that describe SCOs, the content structure, the sequencing rules, etc.). For content packaging, you may want to use a specialized post-production application such as the Reload Editor.

SCORM content packaging applications generally allow you to:

Handy Downloads

Sample Run-Time Environment:
http://www.adlnet.gov/Technologies/scorm/SCORMSDocuments/2004%204th%20Edition/SRTE.aspx

Test Suite:
http://www.adlnet.gov/Technologies/scorm/SCORMSDocuments/2004%204th%20Edition/Test%20Suite.aspx

SCORM Adopter list:
http://www.adlnet.gov/Technologies/scorm/Custom%20Pages/SCORM%20Adopters.aspx

>> author the manifest, including sequencing and navigation rules;
>> package the content;
>> validate SCORM conformance;
>> test the package in a run-time environment;
>> insert and edit SCORM data model elements; and
>> enter metadata.

As described in the previous section, some authoring tools allow you to program sequencing and navigation rules as well.

Examples of SCORM packaging applications include (in alphabetical order):

eXact Packager
http://giuntilabs.com/info.php?vvu=13

Frameworker for SCORM
http://www.i-a-i.com/view.asp?tid=87

Reload Editor [open source]
http://www.reload.ac.uk/

SCORM Developer's Toolkit
http://www.e-learningconsulting.com
/products/SCORM-source-code.html

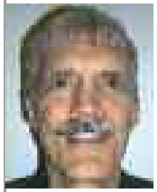
SCORM Driver
http://www.scorm.com/products
/scormdriver.aspx

Scormworks (formerly Tenereo)
http://www.eduworks.com/

Thesis
http://www.GetThesis.com/elearning.htm

Trident
http://www.scormsoft.com/trident

To learn more about ADL, SCORM, or authoring tools in general, visit www.ADLNet.gov.



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E-learning Development Tools

Web-based e-learning development tools

>> Authoring Instructional Materials (AIM - government owned)
http://nawctsd.navair.navy.mil/Programs/TrainerDescriptions/UnderseaPrograms/AIM.cfm

>> Content Point
http://www.atlantic-link.co.uk/

>> Course Avenue
http://www.courseavenue.com

>> Firefly Publisher
http://www.mzinga.com

>> Force Ten
http://www.outstart.com

>> Ilias SCORM Editor [open source - currently unavailable: will be included in the next Ilias 3.11 release)
http://www.ilias.de

>> Krues (government owned)
http://www.lsijax.com/prodserv/tss/webtools/kreus.htm

>> Luminosity
http://www.cm-luminosity.co.uk/

>> Mohive
http://www.mohive.com/index.asp?cls=product

>> RapideL
http://www.rapidel.com/rapideli.html

Desktop-based e-learning development tools

>> Captivate
http://www.adobe.com/products/captivate/

>> Desktop Development Suite
http://www.outstart.com/desktop-development-suite-overview.htm

>> E-learning Suite
http://www.adobe.com/products/elearningsuite/

>> eXe http://exelearning.org/

>> Learning Content Development System (LCDS)
http://www.microsoft.com/learning/tools/lcds/default.mspx

System simulation development tools

>> Captivate
http://www.adobe.com/products/captivate/

>> Capture Point
http://www.atlantic-link.co.uk/home_capturepoint.htm

3-D simulation development tools

>> ESP
http://www.microsoft.com/esp/

>> Flex
http://www.adobe.com/products/flex/

>> Thinking Worlds
http://www.thinkingworlds.com/